datron

OPERATING MANUAL

for

DATRON MODEL 1045/55

DIGITAL VOLTMETER

METEOR CLOSE

NORWICH AIRPORT INDUSTRIAL ESTATE NORWICH NR6 6HQ ENGLAND

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SECTION 1

GENERAL DESCRIPTION

1.1 INTRODUCTION

The 1045 and 1055 Digital Voltmeters are high precision, high stability instruments dedicated to the accurate measurement of DC voltages. They offer the user an economical solution to the problem of precision DC voltage measurement in the 1 microvolt to 1 kilovolt range. Of particular importance is the fully floating input stage capable of swinging through ± 20 volts and thus maintaining very high input impedance up to these voltages.

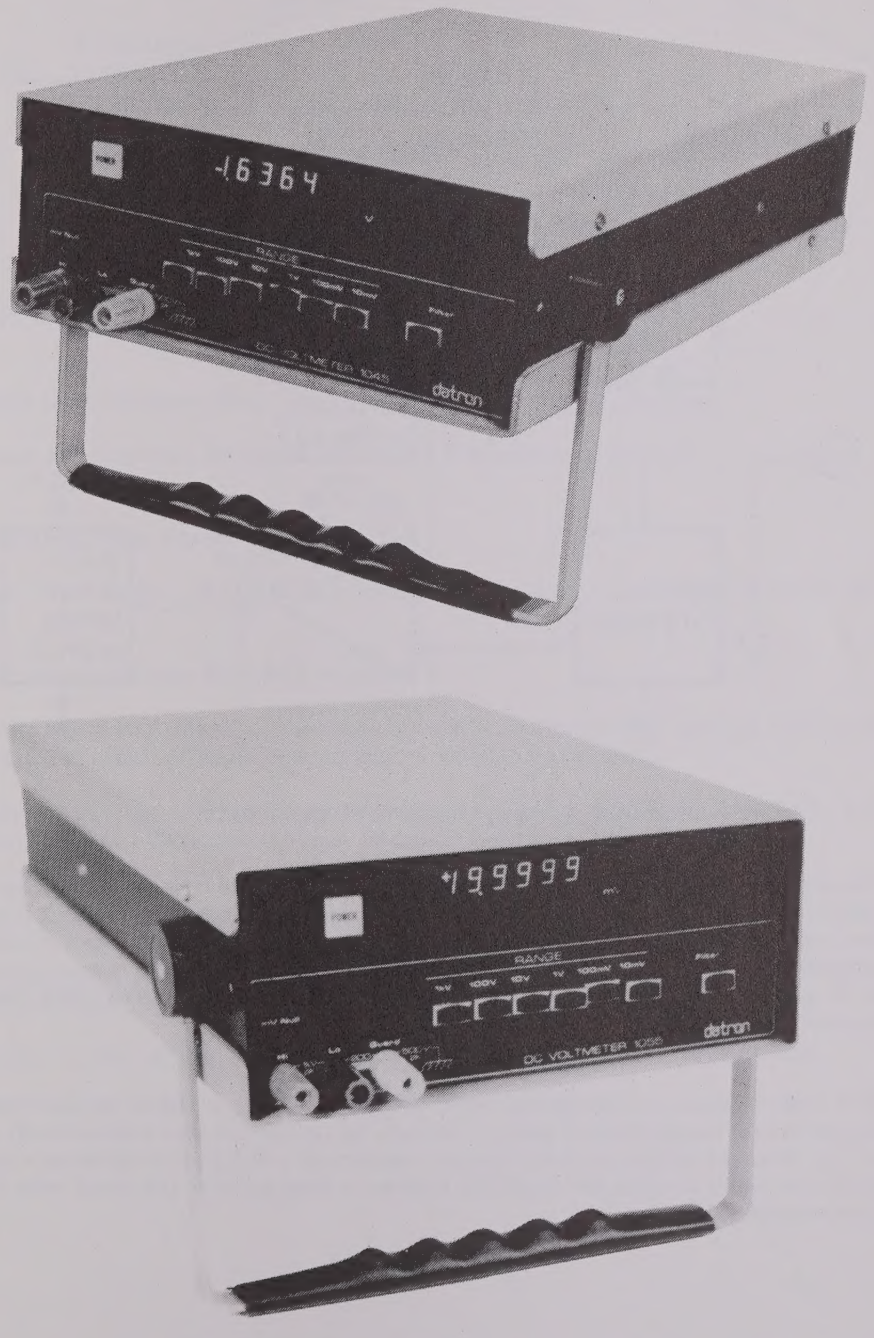


FIG. 1.1 1045 and 1055 DVMs.

1.2 FUNCTIONS AND FACILITIES

The digital voltmeter comprises a fully floating isolation amplifier with switched gain ranges which provides an output for conversion to a digital reading. This reading may then be converted to BCD format and made available via the BCD Output Option which also allows remote commanding of the sample and read functions of the voltmeter. The filter networks provide additional noise rejection allowing true measurements in very high noise levels.

1.3 GENERAL ELECTRICAL DESCRIPTION

For a detailed electrical description, maintenance and repair procedures, component lists and circuit diagrams refer to the appropriate Servicing Manuals (850025–1045, 850026–1055).

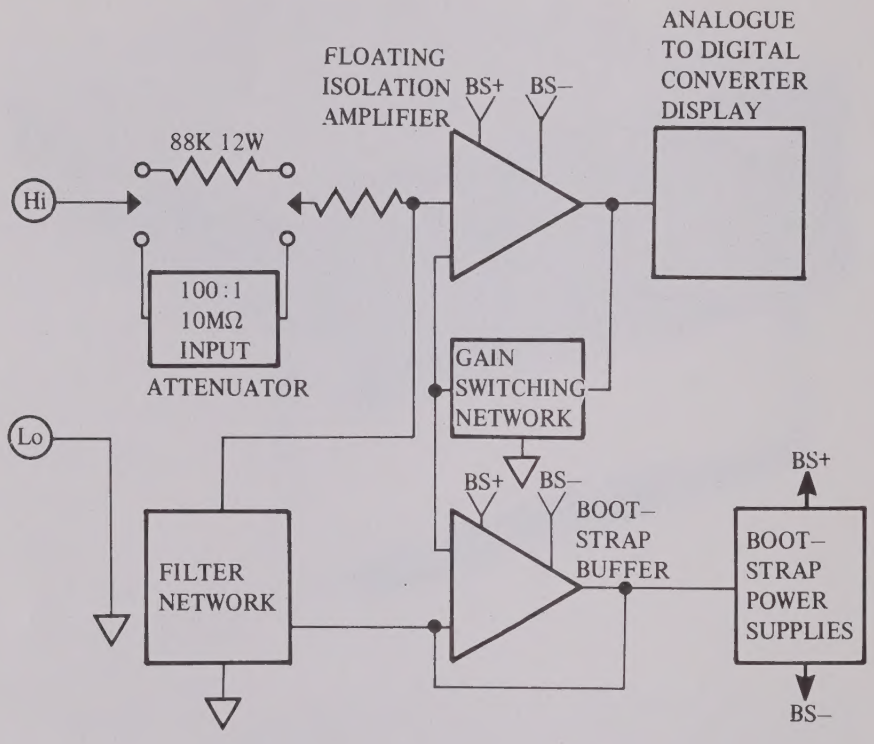


Fig 1.2 SIMPLIFIED BLOCK DIAGRAM

The analog to digital conversion technique used converts the signal from the DC Isolator into a time period directly proportional to the input voltage. The DC Isolator output is a 0 to 1 V signal which is amplified by a factor of 5 and then applied via electronic switching to the input of a high gain integration amplifier. The integration capacitor starts charging from a zero state at a rate proportional to the input voltage. The integration period lasts approximately 20mS during which time the capacitor acquires a charge proportional to V_{in}.

At the end of 20mS, a 5 volt reference signal of opposite polarity to that of the input signal is applied and the length of time it takes to discharge the capacitor to zero volts is directly proportional to V_{in}. When the voltage across the capacitor reaches zero a Null Detector produces a signal to strobe the display circuitry, disconnect the reference voltage and reset the circuit ready for the next measurement cycle.

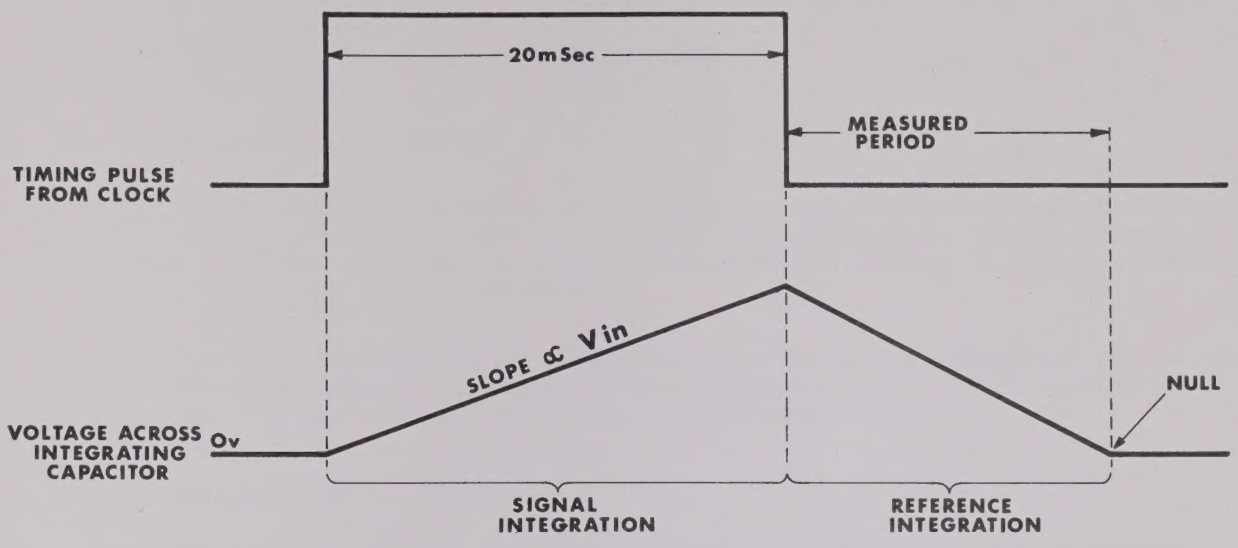


FIG 1.3 MEASUREMENT CYCLE TIMING

1.4 OPTIONS

1.4.1 Analog Output (Option AO1)

Option AO1 provides a DC output voltage of 1 V for any full range input.

1.4.2 Parallel Rear Input (Option RO1)

Option RO1 accepts a rear input via a 5-way connector wired in parallel with the front panel terminals.

1.4.3 BCD Outputs (Options BO1, BO2 and BO6).

Option BO1 (1045 only) is an electrically isolated BCD output facility which gives indications of reading and range, and allows external control of the A-D converter.

Options BO2 (1045 only) and BO6 (1055 only) give the same information as BO1 but, as they have 3-state outputs, a single input line may be used to completely disable all outputs.

1.4.4 Fast Read Rate (Option FO1) 1045 only.

This option decreases the settling time of the input circuitry to enable 20 readings per second instead of the standard 10 per second. This slightly degrades the AC Normal Mode rejection.

NOTE: The 1055 has a maximum read rate of 20 readings per second as standard.

SECTION 2

INSTALLATION

2.1 UNPACKING AND INSPECTION

NOTE: Should your instrument have been subjected to excessive mishandling in transit the fact will probably be visible as external damage to the shipping carton. Unpack the instrument and check for external damage to case, pushbuttons, terminals, etc. If any damage is found, notify the carrier immediately.

Every care is taken in the choice of packaging materials to ensure that your new instrument will reach you in a perfect condition. Our packaging and protection are adequate to cater for all the normal hazards of road or rail transit. Special export packaging is provided for overseas orders.

2.2 INSTALLATION

The instrument is housed in a robust, heavy-gauge aluminium case so designed to withstand the rough knocks of industrial usage. The handle pivots are fitted with detent mechanisms enabling the carrying handle to be used as a prop stand giving a variety of viewing angles. A detachable supply lead, comprising two metres of 3-core P.V.C. sheath cable permanently moulded to a fully-shrouded 3-pin cable socket is included. This fits at the rear of the instrument and should be pushed firmly home. Connect the supply lead to a 3-pin plug (fused 1 amp), ensuring that the instrument case is earthed via the Yellow/ Green earthing wire.

2.2.1 Voltage Tappings

The instrument is packed ready for use with 205V to 255V, 48 to 440Hz supplies, unless otherwise specified at the time of ordering. For operation from supplies in the range 105V to 127V, 48 to 440Hz, it is necessary to alter the connections to the primary windings of the main transformer.

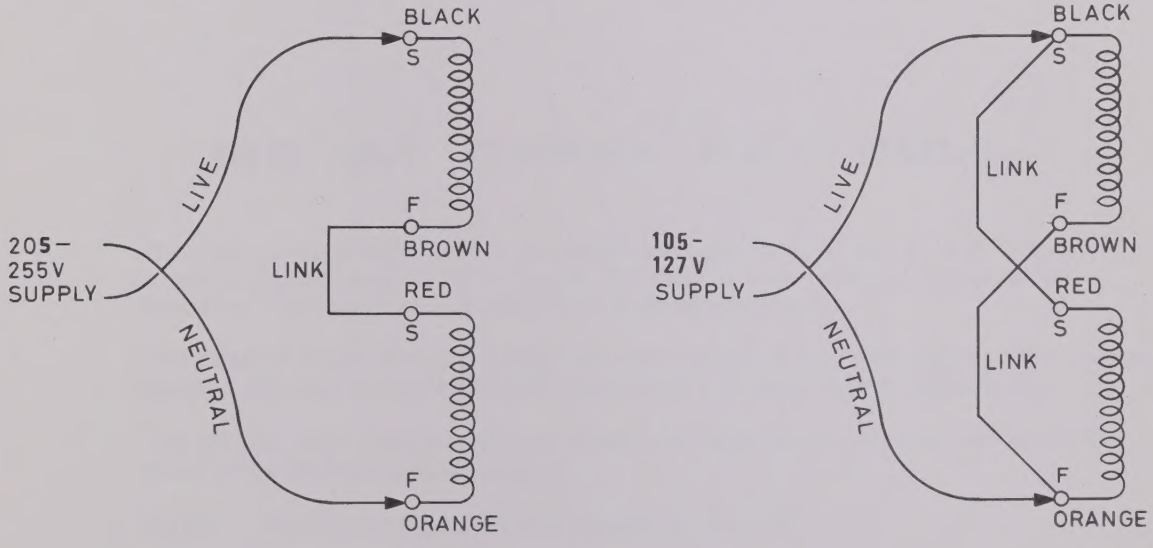


Fig 2.1 Mains transformer tappings

To change the working voltage, remove the top cover of the instrument and locate the mains transformer in the right hand rear corner of the instrument.

For 205V to 255V operation the Red and Brown wires are connected to a linking post located between the LIVE (Black) and NEUTRAL (Orange) posts.

For 105V to 127V operation the Red wire is connected to the post with the Black wire (LIVE) and the Brown wire is connected to the post with the Orange wire (NEUTRAL).

2.3 SWITCH-ON

(i) Ensure that the instrument is correctly adjusted for the mains supply to which it is to be connected. Unless otherwise specified on order it will have been connected for 205V-255V working. If in doubt check as described in Section 2.2.1.

NOTE: No fine tapping adjustments are required for voltages within each of the major ranges.

(ii) Connect the mains supply lead.

(iii) Switch on the supply and allow the equipment to stabilise. A minimum of 2 hours warm-up should be allowed to reach full specification although the instrument will be operational within a few seconds.

(iv) Before proceeding any further, read Section 3, CONTROLS AND CONNECTIONS and Section 5, OPERATION AND APPLICATIONS.

SECTION 3

CONTROLS AND CONNECTIONS

3.1 INTRODUCTION

This section details the manual and remote facilities of the 1045 and 1055 voltmeters.

3.2 FRONT PANEL

The locations of the front panel controls are shown in Fig. 1.1.

3.2.1 Power

A push button switch with alternate ON/OFF action mounted at the left of the display above the input terminals. It isolates the mains supply live from the instrument, with the exception of the mains fuse socket and filter which remain live unless the supply lead is disconnected.

3.2.2 Range Controls and Display

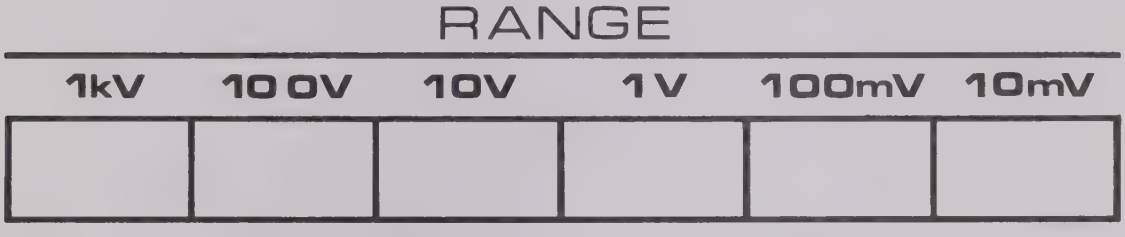


FIG 3.1 RANGE CONTROLS

The range controls comprise a set of six switches interlocked such that only one may be depressed to select a particular range. They are marked with their full range values and a corresponding indication of the selected range is displayed with the value measured.

OVERRANGE is signified by a 1 being illuminated at the left of the normal display. 100% overrange permits a maximum display of 19999(9) except on the 1 kV range which is 1000.0(0) max.

OVERLOAD. Above 100% overrange of 19999(9) the display blanks out (apart from the decimal point) until a less sensitive range is selected.

NOTE: Numbers in brackets indicates presence on 1055 only.

An indication of the selected range is supplied via the BCD output option if this is fitted.

3.2.3 Filter

Depressing the FILTER button increases the series mode AC noise rejection and slows down the response time of the analogue circuitry.

An indication of the selection of FILTER is supplied via the BCD Output Option connector.

3.2.4 mV Null

This is a screwdriver-operated multi turn preset control to enable the instrument to be adjusted for zero indication with zero input signal applied to the 10mV or 100mV range. Its range is approximately ± 80 microvolts and it can then be used very effectively to compensate for external offsets as well as the very low, long term zero drift of the instrument.

3.2.5 Input Connections

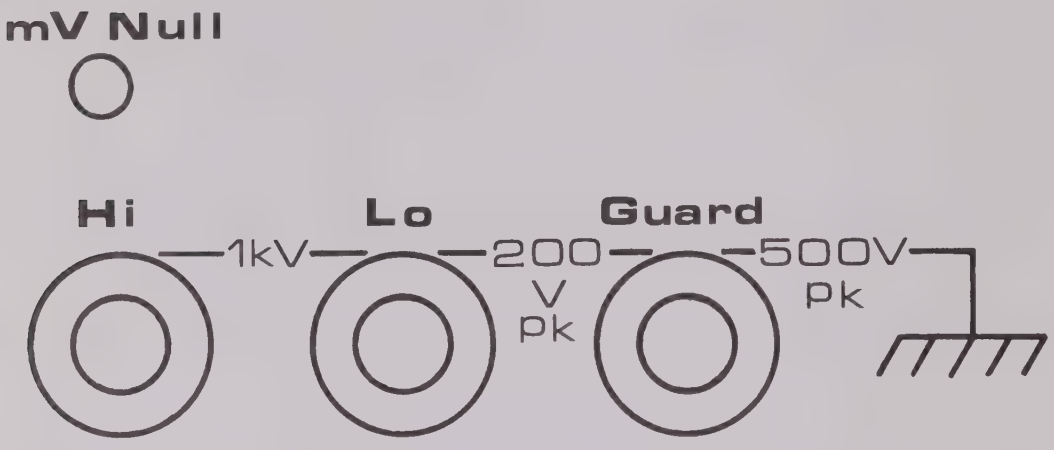


FIG 3.2 INPUT CONNECTIONS

Three signal input terminals are located on the front panel marked respectively Hi, Lo and Guard. These terminals may be used as 'binding-posts', or connection may be made using 4 mm banana plugs. The terminals are mounted on standard ¾" spacing between centres, enabling double or triple banana-plug adaptors to be used.

In order to minimise thermal EMF, copper wire should be used for connecting the instrument and preferably passed through the side entry holes of the Hi and Lo terminals.

NOTE: The following input voltages must not be exceeded under any circumstances.

Signal Hi to Signal Lo	1000 volts peak.
Signal Lo to Guard	250 volts peak.
Guard to Earth	500 volts peak.

Full details of the recommended methods of making connection between the input terminals and the circuit under test are given in Section 5.2.

3.3 REAR PANEL

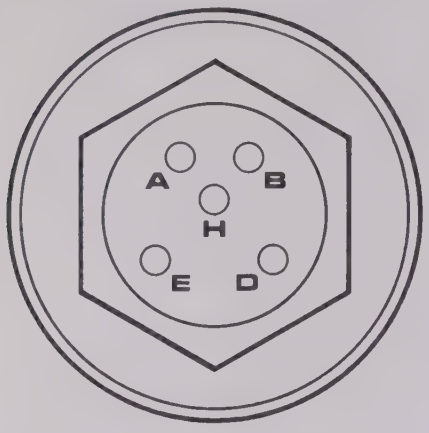
3.3.1 Power

POWER SOCKET – A 3-pin CEE regulation 250V, 6A power socket accepts the mating plug which is integrally moulded with the power lead.

POWER FUSE – the supply to the mains transformer primary windings is protected by a 20 mm x 5 mm glass cartridge, anti-surge type fuse, rated 160 mA for 230V operation or 230 mA for 115V operation.

3.3.2 Connectors

3.3.2.1 Analog Output (Option)



A - Output Hi

B - Output Lo

Fig 3.3 Analog Output – Pin Layout and Designations

5 pin socket connector viewed from rear of instrument.

The analogue output is presented from the rear panel via a 5-pin 'M' series connector and a fast-acting fuse in the Hi side. It is a 1 volt full range, output for any nominal full range input, with overrange capability to 2 volts. The output impedance is approximately 100 ohms.

It may be more convenient for a user to apply the input signal via the rear rather than the front panel. The spare pins on the analog output connector can be used as follows:–

E	–	Input Hi
D	–	Input Lo
H	–	Guard

NOTE: Since high voltages may be present on the input the connector must be wired with great care to prevent shorting or arcing.

3.3.2.2 BCD Output – Option.

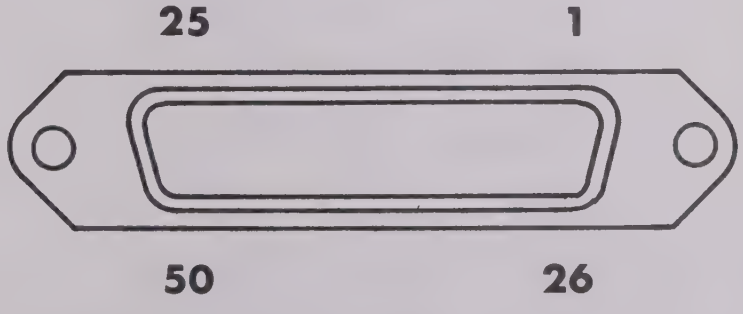


FIG 3.4 AMPHENOL CONNECTOR – PIN LAYOUT VIEWED FROM REAR OF INSTRUMENT

A 50-way AMPHENOL 'BLUE RIBBON' connector carrying TTL logic level signals as designated in the following table, Fig. 3.5. Refer to Section 5.4 for details of use.

FIG. 3.5 BCD Output - Pin Designations

J5 Pin No.	Function	Description
1	2×10^{-4}	BCD Output No. (assuming 1V range)
2	4×10^{-4}	" " "
3	8×10^{-4}	" " "
4	1×10^{-4}	" " "
5	2×10^{-3}	" " "
6	4×10^{-3}	" " "
7	8×10^{-3}	" " "
8	1×10^{-3}	" " "
9	2×10^{-2}	" " "
10	4×10^{-2}	" " "
11	8×10^{-2}	" " "
12	1×10^{-2}	" " "
13	2×10^{-1}	" " "
14	4×10^{-1}	" " "
15	8×10^{-1}	" " "
16	1×10^{-1}	" " "
17	OVERLOAD	Indicates signal greater than 19999(9)
18	1×10^{0}	BCD Output No. Overrange
19	2×10^{-5}	" " ")
20	4×10^{-5}	" " ")
21	8×10^{-5}	" " ") 1055 Only
22	1×10^{-5}	" " ")
23	Not used	
24	Not used	
25	Not used	
26	$\overline{\text{MINUS POLARITY}}$	0 indicates negative reading
27	$\overline{\text{PLUS POLARITY}}$	0 indicates positive reading
28	Not used	
29	Not used	
30	Not used	
31	$\overline{\text{FILTER}}$	0 indicates FILTER: 1 NORMAL
32	$\overline{\text{mV}}$	0 indicates mV: 1 indicates Volts
33	Not used	Do not connect
34	RANGE A	)
35	RANGE B	) Decimal Point Coding (Range)
36	RANGE C	) see Fig. 3.6.
37	RANGE D (1045 only)	)
38	Not used	Do not connect
39	Digital COMMON	0 state reference
40	$\overline{\text{HOLD}}$	Input control line
41	$\overline{\text{COMMAND}}$	Input control line
42	$\overline{\text{PRINT INHIBIT}}$	Input control line
43	SIG. INTEGRATE	1 indicates DVM sampling input signal
44	$\overline{\text{DELAY}}$	Input control line
45	$\overline{\text{PRINT COMMAND}}$	↓ indicates sample completed and data available.
46	Not used	
47	Not used	
48	Not used	
49	Not used	
50	Not used	

FIG. 3.6 1045/55 Range Coding

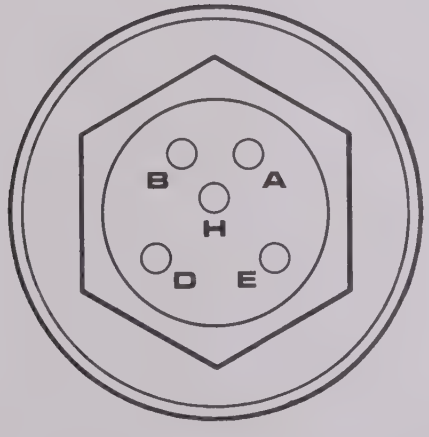
1045 Range Coding

RANGE	PIN 34(A)	PIN 35(B)	PIN 36(C)	PIN 37(D)
10mV	1	0	1	1
100mV	1	1	0	1
1 V	0	1	1	1
10 V	1	0	1	1
100 V	1	1	0	1
1 kV	1	1	1	0

1055 Range Coding

RANGE	PIN 34(A)	PIN 35(B)	PIN 36(C)
10mV	1	0	0
100mV	0	1	0
1 V	1	1	0
10 V	0	0	1
100 V	1	0	1
1 kV	0	1	1

3.3.2.3 Rear Input – Option



D – Input Lo

E – Input Hi

H – Guard

Fig 3.7 Rear Input – Pin Layout and Designations

5 pin connector viewed from rear of instrument

If a rear input connector is fitted then the front panel terminals may be omitted for safety reasons. If the front terminals are retained, care should be taken to ensure that inputs are only applied EITHER to the front panel terminals OR via the rear input connector.

IT SHOULD ALSO BE NOTED THAT ANY VOLTAGE APPLIED TO THE REAR INPUT WILL BE PRESENT AT THE FRONT PANEL TERMINALS WHICH MAY THEREFORE BE AT A DANGEROUS POTENTIAL.

SECTION 4

SPECIFICATION AND SPECIFICATION VERIFICATION

4.1 SPECIFICATIONS

4.1.1 General

Power Supply	205 – 255 or 105 – 127 volts, 48 - 440 Hz. Specify line frequency and voltage when ordering. Consumption is approximately 12 VA.
Operating Temperature	0^{o} to 50^{o}C.
Storage Temperature	-25^{o}C to $+70^{o}$C.
Dimensions	H = 90 mm (3.5"), W = 224 mm (8.8"), D = 330 mm (13").
Weight	1045 – 8 lbs (3.63 kg), 1055 – 8.8 lbs (4 kg.).
Rack Mounting	"Ears" mounted on side of instrument.
Specification Validity	For 6 months over 18 – 28^{o}C or as described.
Maximum Input Voltage (Without damage)	Signal Hi to Signal Lo 1000V (Any Range) Signal Lo to Guard 250V peak Guard to Earth (Case) 500V peak
Input Resistance (Rin)	10 mV to 10V ranges (up to 20V) Rin $>$ 10,000 MΩ 100V and 1,000V ranges Rin = 10 MΩ ± 0.1%
Input Current	$<$ 50 pA drifting at typically 3 pA/^{o}C.

4.1.2 1045 only

Ranges	10.000 mV, 100.00 mV, 1.0000 V, 10.000 V, 100.00 V, 1000.0 V.
Overrange	100% i.e. 19999 full scale (FS) on all ranges except 1000.0 V.
Accuracy	Six months duration @ 23 ± 5^{o}C after mV offset adjustment. ± 0.01% reading ± 0.005% FS ± 1 μV.
Temperature Coefficient	± One tenth of above accuracy rating/^{o}C ± 0.2 μV/^{o}C.
Stability	After first six months of use better than the above accuracy rating per year plus microvolt offset stability of typically $<$ 2 μV per month.
Common Mode Rejection (1 kΩ Source Unbalance)	DC $>$ 140 dB AC $>$ 80 dB + SERIES MODE.
Series Mode Rejection	**FILTER OUT** $>$ 20 dB @ 50 Hz increasing at 30 dB per octave + notch rejection. **FILTER IN** $>$ 57 dB @ 50 Hz increasing at 18 dB per octave + notch rejection. **NOTCH REJECTION** $>$ 50 dB @ line frequency ± 0.15%. **(OPTION FO1)** $>$ 36 dB @ line frequency ± 1%.

Settling Time (to 0.01%)	**FILTER OUT**	< 78 msec.
	FILTER IN	< 350 msec.
	OPTION FO1	< 5 msec.
Read Rate	Normal internally triggered read rate ~ 2.5 readings/sec. Maximum externally triggered read rates:– **FILTER OUT** 10 readings/sec. **FILTER OUT (FO1)** 20 readings/sec. **FILTER IN** 2.5 readings/sec.	
Analogue Output Accuracy	As normal specifications ± .01% FS.	
Range	0 ± 2 Volts, 1 Volt per nominal Full Range.	
Output Resistance	< 100 Ohms.	
Protection	Fuse protected against accidental overload in Output Hi lead.	
BCD Output	**OPTION BO1**. Reading, range and function, 1.2.4.8 +ve True TTL compatible code. External hold, and read command input facilities are provided together with signal integrate and print command output flags. FAN-OUT 2 TTL LOADS, FAN-IN 1. **OPTION BO2.** Is as BO1 but with the facility of turning all the outputs into a high impedance condition, and disabling all the inputs.	

4.1.3 1055 only

Ranges	10.0000 mV, 100.000 mV, 1.00000 V, 10.0000 V, 100.000 V, 1000.00 V.	
Overrange	100% i.e. 199999 full scale (FS) on all ranges except 1000.00 V.	
Accuracy (6 months)	After mV offset adjustment, all ranges. ± 0.005% reading ± 0.0005% FS ± 1 microvolt.	
Temperature Coefficient	± 1/10 [of above accuracy rating] /^{o}C ± 0.2 microvolts/^{o}C.	
Stability	After six months use better than 50 ppm per year.	
Short Term Accuracy	As above but .002% reading 24 hrs 22 – 24^{o}C. .004% reading 90 days 18 – 28^{o}C.	
Common Mode Rejection (1 kΩ Source Unbalance)	DC > 140 dB AC > 80 dB + SERIES MODE up to 180 dB.	
Series Mode Rejection	**FILTER OUT** (100 mV – 1 kV)	> 70 dB notch at line frequency and multiples of line frequency.
	FILTER IN (100 mV – 1 kV)	> Above notch + 36 dB at 50 Hz increasing at 40 dB per decade.
	10 mV Range	> Above + 46 dB at 50 Hz increasing at 20 dB per decade.
Settling Time (to .001%)	**FILTER OUT**	< 5 milliseconds.
	FILTER IN	< 350 milliseconds.
	10 mV range only approximately 10 seconds.	

Read Rate	Normal internally triggered read rate ~ 2.5 readings/sec. Maximum externally triggered read rate:– **FILTER OUT** 20 readings/sec. **FILTER IN** 10 readings/sec.
Analogue Output Accuracy	As normal specifications ± .01% FS.
Range	0 ± 2 Volts, 1 Volt per nominal Full Range.
Output Resistance	< 100 Ohms.
Output Current	Up to 5 milliamps.
Protection	Fuse protected against accidental overload in Output Hi.
BCD Output	Option BO6 gives reading, range and function 1.2.4.8 +ve true TTL compatible code. External Hold and Read Command facilities are provided together with signal integrate and print command output flags. FAN OUT : 2 TTL LOADS, FAN IN : 1. Provided as standard is the facility of turning all the outputs into a high impedance condition (i.e. "OFF") and disabling all inputs. Option is electrically isolated from the signal input terminals and referred to power ground via a 100 kΩ resistor.

4.2 SPECIFICATION VERIFICATION

4.2.1 Description

The following steps form a routine for checking that the instrument is working within its specified accuracy where the intention is not to re-calibrate internally. It is thus useful for incoming inspection or routine calibration checks.

It is recommended that due to the wide measurement capability of the instrument, only those aspects of the specification relevant to normal use be verified. This saves considerably in both time and calibration equipment, especially where the 1 μV resolution is not required. For general purpose measurements, the whole procedure should be followed to verify the entire specification.

NOTE: Ideally the specification verification procedure should be carried out with the instrument at 23°C, but the specification is valid from 18°C to 28°C. Measurements taken outside this temperature range should take into account the specified temperature coefficients in order to verify the specification.

4.2.2 Instrument Requirements

A DC source is required of accuracy at least three times better than the accuracy being verified, from 10 mV to 1000 V.

Examples:

Julie Research DVS 106

Fluke source model 332D

with Fluke reference divider model 750A

or other precision 100 : 1 Divider.

4.2.3 Procedure – DC Performance 1045

(i) Turn on the instrument to be checked and allow a minimum of 2 hours to warm up (see Section 2.3, SWITCH-ON).

(ii) Switch instrument to 1 volt range. With the link provided or with wire, connect signal Lo to Guard.

(iii) Connect Hi to Lo with a short link. Check the instrument reads 0.0000 ± 0.0001.

(iv) Apply + 1.0000 volts; check reading is
+ 1.0000 ± .0002

(v) Apply –1.0000 volts; check reading is
–1.0000 ± .0002

If (iii) to (v) are passed, this indicates that most of the instrument is working correctly. If it is failed by more than 0.3% then it is likely that there is a fault rather than a calibration error.

(vi) Select 10V range. Apply +10.000 V, check reading is
+10.000 ± .002

(vii) Apply –10.000 V, check reading is
–10.000 ± .002

(viii) Select 100V range. Apply +100.00 V, check reading is
+100.00 ± .02 V

(ix) Apply –100.00 V, check reading is
–100.00 ± .02 V

(x) Select 1 kV range. Apply +1000.0 V, check reading is
+1000.0 ± 0.2 V

(xi) Apply –1000.0 V. check reading is
–1000.0 ± 0.2 V

(xii) Select 10 mV range. Turn DC source down to zero. Allow several minutes for thermal e.m.f.'s to disappear or stabilize.
Adjust mV offset for display of ± 0.000

Apply +10.000 mV, check reading is
+10.000 ± 0.003 mV

(xiii) Apply –10.000 mV, check reading is
–10.000 ± 0.003 mV

(If changing polarity involves reversing leads, check zero again as thermal e.m.f.'s may have changed).

(xiv) Select 100 mV range. Apply +100.00 mV, check reading is
+100.00 ± 0.02 mV

(xv) Apply –100.00 mV, check reading is
–100.00 ± 0.02 mV

(xvi) For linearity check, select 1 volt range.

Apply +0.1000 V, check reading is
+0.1000 V ± 0.0001 V

(xvii) Apply +0.5000 V, check reading is
+0.5000 ± 0.0001/2

(xviii) Apply +1.0000 V, check reading is
+1.0000 ± .0002

(xix) Apply +1.9000 V, check reading is
+1.9000 ± .0003

If all the checks given in Section 4.2.3 are passed, the model 1045 is within its calibration specification.

4.2.4 **Procedure – DC Performance 1055**

(i) Turn on the instrument to be checked and allow a minimum of 2 hours to warm up (see Section 2.3, SWITCH-ON).

(ii) Switch instrument to 1 volt range.

(iii) Connect Hi to Lo with a short link. Check the instrument reads .00000 ± .00001.

(iv) Apply +1.00000 V, check reading is
+1.00000 ± .00005 V

(v) Apply –1.00000 V, check reading is
–1.00000 ± .00005 V

If (iii) to (v) are passed this indicates that most of the instrument is working correctly. If it is failed by more than 0.3% then it is likely that there is a fault rather than a calibration error.

(vi) Select 10 V range. Apply +10.0000 V, check reading is
+10.0000 ± .0005 V

(vii) Apply –10.0000 V, check reading is
–10.0000 ± .0005 V

(viii) Select 100 V range. Apply +100.000 V, check reading is
+100.000 ± .005 V

(ix) Apply –100.000 V, check reading is
–100.000 ± .005 V

(x) Select 1 kV range. Apply +1000.00 V, check reading is
+1000.00 ± .05 V

(xi) Apply –1000.00 V, check reading is
–1000.00 ± .05 V

(xii) Select 10 mV range. Turn DC source down to zero. Allow several minutes for thermal e.m.f.'s to disappear or stabilize.
Adjust mV offset for display of ± 0.0000

Apply +10.0000 mV, check reading is
+10.0000 ± .0015 mV

(xiii) Apply –10.0000 mV, check reading is
–10.0000 ± .0015 mV

(If changing polarity involves reversing leads, check zero again as thermal e.m.f.'s may have changed. If possible reverse polarity at a higher voltage level so as not to reverse thermals).

(xiv) Select 100 mV range. Turn DC source down to zero. Allow several minutes for thermal e.m.f.'s to disappear or stabilize.
Adjust mV offset for display of ± 0.000

Apply +100.000 mV, check reading is
+100.000 ± .006 mV

(xv) Apply –100.000 mV, check reading is
-100.000 ± .006 mV

(If changing polarity involves reversing leads, check zero again as thermal e.m.f.'s may have changed. If possible, reverse polarity at a higher voltage level so as not to reverse thermals).

This concludes checking of accuracy.

(xvi) For linearity check, select 1 volt range.

Apply +0.10000 V, check reading is
+0.10000 ± .00001 V

(xvii) Apply +0.50000 V, check reading is
+0.50000 ± .00003 V

(xviii) Apply +1.00000 V, check reading is
+1.00000 ± .00005 V

(xix) Apply +1.90000 V, check reading is
+1.90000 ± .00009 V

If all the checks given in 4.2.4 are passed, the model 1055 is within its calibration specification.

SECTION 5

OPERATION AND APPLICATIONS

5.1 INTRODUCTION

This section is intended as a guide to the use of the instrument and should be read in conjunction with Section 2.3 SWITCH-ON, Section 3 CONTROLS AND CONNECTIONS with special reference to Section 3.2.5 Input Connections.

5.2 COMMON MODE AND GUARD

Common Mode Voltages are equally present on both terminals of the voltage source being measured and excessive levels, either AC or DC, can affect the measurement being made. However, sensible use of the GUARD terminal can reduce errors to a negligible level.

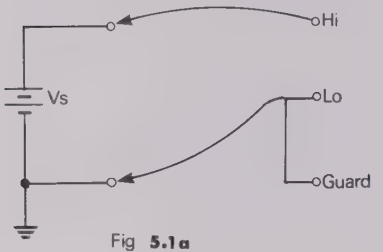


Fig **5.1a**

The disadvantage of the simple arrangement in Fig. 5.1(a) is that the connecting leads form a loop. If a stray alternating magnetic field from the mains transformer of a neighbouring instrument passes through the loop it will behave as a single turn secondary winding, and unwanted AC voltages will be induced into the measuring circuit.

The GUARD terminal should be used when the source to be measured presents an unbalanced impedance to the measuring terminals and Common Mode Voltages are present. In general, regardless how the Hi and Lo terminals are connected, the GUARD terminal should refer to the source of Common Mode Voltage as shown in Figs. 5.1 (b), (c), (d), and (e).

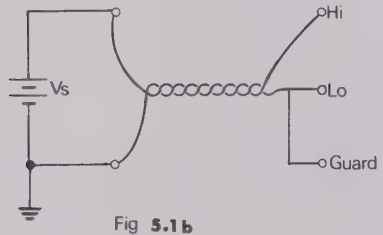


Fig **5.1b**

Fig. 5.1(b) is a better arrangement, where the twisted pair reduces the loop area and adjacent twists of the wires produce cancellation of any induced voltages.

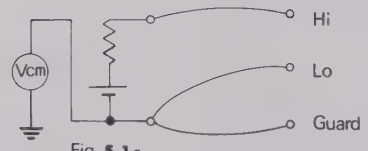


Fig **5.1c**

The simple case in Fig. 5.1(c) allows the GUARD to be connected remotely or at the terminals since in both cases it is to the source of Common Mode Voltages.

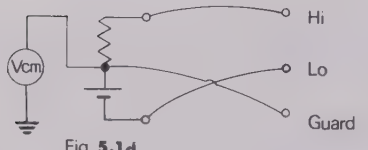


Fig **5.1d**

Fig. 5.1(d) shows a case where the Common Mode Voltage is not present on the Lo measurement terminal and should therefore be connected remotely.

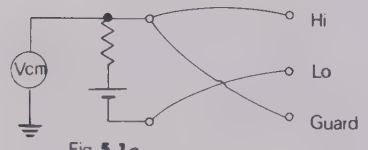


Fig **5.1e**

Fig. 5.1(e) shows an extreme situation where all the unbalance to Common Mode Voltage is in the Lo lead and GUARD must therefore be connected to Hi.

The cases illustrated on page 19 show the connections made by use of individual wires. It is recommended, however, that a screened twisted pair microphone cable be used with the GUARD terminal connected to the screen. Table 5.2 below lists the recommended types.

FIG. 5.2 Recommended Input Cables

Manufacture	Type	pF/metre	Outside diameter
Suhner	G03939	65	4.6 mm
Suhner	CB04730	195	5.3 mm
Transradio	MC 02-A	115	4.4 mm
Transradio	MC 02-D	130	3.5 mm
B.I.C.C.	9442Y	120	5.7 mm

When making a particular measurement, choose the most suitable method of connection and check that it does not involve exceeding any of the input voltages listed under Section 3.2.5.

5.3 THERMAL E.M.F.

Where very low level measurements are being made, care must be taken to minimise and balance thermal e.m.f. generated in the leads. In general, the use of steel probes, croc-clips and all metals with the exception of copper is to be avoided.

5.4 BCD OUTPUT OPTIONS

This allows external control of the A-D converter and outputs indications of range and reading via the BCD output connector as detailed in Section 3.3.2.2.

In these options the outputs are isolated from the signal input terminals and referred to earth via a 100 kΩ resistor.

Whilst it is recommended that the output digital common be referred to true earth, the input terminals may be floated as high as 500V relative to true earth and digital common.

All levels are TTL compatible with a fan-out of 2.

Options BO2 and BO6 are 3-state (or Tri-State*) versions of the Option BO1. The difference being that a logic '0' to $\overline{\text{PRINT INHIBIT}}$ forces all output lines to a third, inactive state, which is a very high impedance, OFF, state.

This enables the instrument to be permanently connected to logic highways or bus-bars in a system and then, by the application of a single logic '0' to $\overline{\text{PRINT INHIBIT}}$, be electrically disconnected when required.

The following description of signals refers to Fig. 3.5. Bar notation indicates that a low level (less than 0.4V) is the active state of the line.

> There are 4 output lines for each digit indicating the BCD equivalent of its value, with single lines to indicate overrange and overload. There are single lines which when at logic '0' indicate polarity, filter selected and 100 mV DC selected. Indication of the selected range is given as the coding on 4 lines as shown in Fig. 3.6.

* Trade Mark: National Semiconductors

The A-D Converter control lines are as follows:–

(i) $\overline{\text{PRINT COMMAND}}$ falls from '1' to '0' at the end of each measurement cycle, indicating that a new reading has been transferred to the storage registers and is available as BCD output information.

This line is a logic '0' except where the BCD information is being updated (a period of about 5mS). It can therefore be used as a data available indication to an external reading device.

A logic '0' on $\overline{\text{PRINT INHIBIT}}$ will disable $\overline{\text{PRINT COMMAND}}$.

(ii) SIGNAL INTEGRATE is a logic '1' when the A-D converter is sampling the input and its falling edge indicates that a new input may be applied.

(iii) $\overline{\text{HOLD}}$ is an input control line which when logic '0' stops the instrument from sampling in its normal free-run mode. When this line goes to '0' the instrument completes any reading in progress and stores and displays it. No further readings will occur unless an external read command is applied or until this line is returned to logic '1'.

(iv) $\overline{\text{COMMAND}}$. A '1' to '0' transition on this control line commands the instrument to take one reading immediately and is only effective when $\overline{\text{HOLD}}$ is a logic '0'. A $\overline{\text{COMMAND}}$ pulse must be at least 2μS duration.

(v) $\overline{\text{DELAY}}$. If this line is held at a logic '0' when $\overline{\text{COMMAND}}$ is applied, then the read command will automatically be delayed by a period of time equal to the settling time of the selected integration filter.

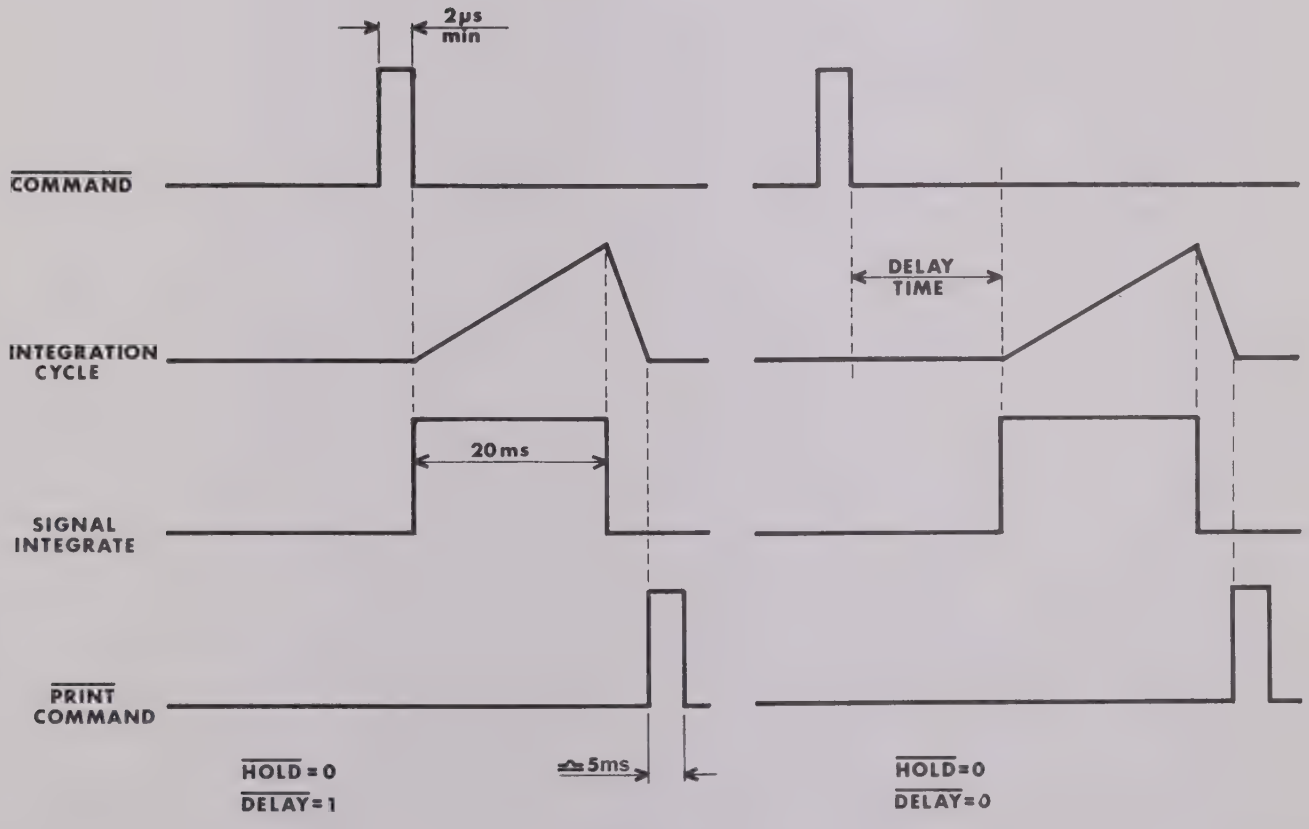


FIG 5.3 SYSTEM OPERATION TIMING

For maximum read rate in a closed-loop system, the command could be the falling edge of SIGNAL INTEGRATE as shown in Fig. 5.4.

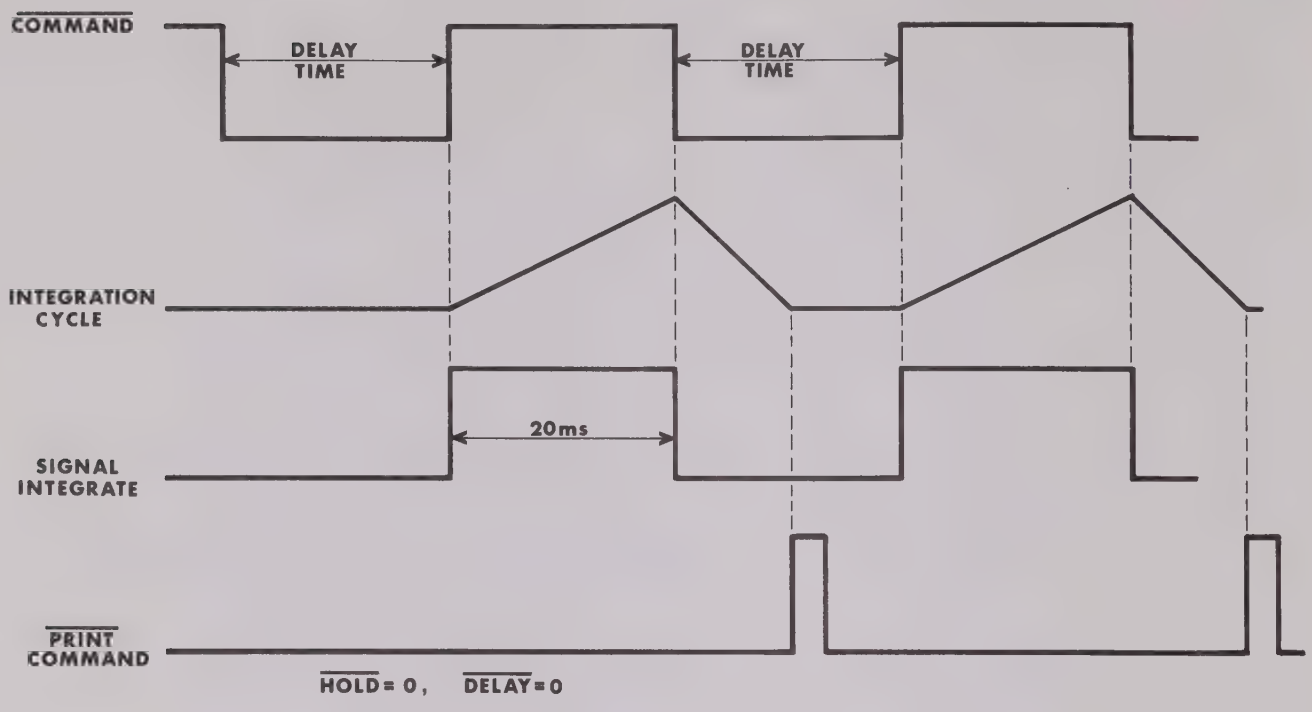


FIG 5.4 CLOSED LOOP SYSTEM OPERATION TIMING

ADDENDUM AND ERRATA SHEETS INDEX

INSTRUMENT: 1045

SERIAL NO: 02034

COMPONENT PARTS AND SERIAL NOS.	ASSOCIATED UPDATE SHEETS

ERRATA SHEETS:

datron

TO: THE USER

Every effort has been made to ensure that the information supplied with the instrument is accurate and up to date. If, however, you find any errors or have any suggestions for improving this Manual, please return the reply card completed as appropriate.

Full information is available on the complete range of Datron products and we will be pleased to forward these to you on request by return of the reply card completed as appropriate.

Name:

Dept:

Company:

Address

Instrument:

Serial No:

Manual Ref. No.:

Correction / Suggestion:

Please send information on the following products:--

Model 1030	True RMS Digital Voltmeter	☐
Model 1041	4½ digit Multifunction Digital Voltmeter	☐
Model 1045	4½ digit DC Digital Voltmeter	☐
Model 1051	5½ digit Precision Multifunction Digital Voltmeter	☐
Model 1055	5½ digit DC Digital Voltmeter	☐
Model 1057	5½ digit Digital Multimeter.	☐
Model 1059	5½ digit Digital Multimeter.	☐
Data Logging Equipment		☐

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